Center Independent Research & Development: GSFC IRAD

NavCube: A fully realized modernized GPS receiver

Completed Technology Project (2014 - 2015)

Project Introduction

The goal of this IRAD project is to complete the technology development of the modernized Navigator-SpaceCube GPS receiver (named the NavCube), enabling a potential on-orbit demonstration in the coming years. The main work items under the proposed project will be to: (i) complete integration and testing of the NavCube hardware with L1/L2 tracking capability and (ii) design and implement a modernized L5 GPS signal tracking capability on Xilinx ML605 (NavDev) development platform.

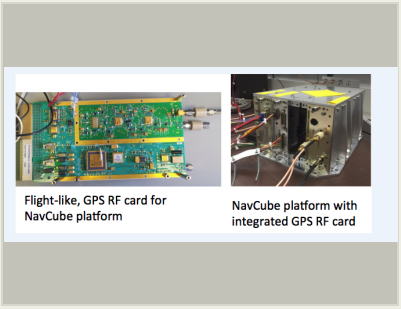
Goddard's Navigator is an in-house space-qualified GPS receiver originally designed to enable high-altitude GPS navigation. Navigator was developed largely under GSFC-IRAD funding with only L1 capability and is now a mission-enabling technology for the challenging Magnetospheric Multi-Scale Mission (MMS), serves as a critical navigation sensor for the Global Precipitation Measuring Mission (GPM) and has supported several other recent programs including HST-SM4, the Orion capsule, GPS-ACE, and NICER/SEXTANT. The Navigator design was licensed to Moog Broad Reach Engineering (MBR) in 2010. The MBR-Navigator is currently being procured by the NICER/SEXTANT mission.

The NavCube builds on the GSFC Navigator GPS receiver design to provide a next-generation receiver, with the capability to process modernized GPS signals on the L1, and L2 frequencies. The new design breaks free from the processing constraints of the original Navigator by targeting the flexible reprogrammable-FPGA based SpaceCube 2.0 digital processing platform augmented with a custom discrete component RF card that supports two frequencies (the current design supports GPS L1 and L2 frequencies, support for L1 and L5 frequencies is possible with a change to some electronic components in the L2 RF chain). Beyond the goals of the current proposal, the NavCube provides ample processing power and flexibility to enable the addition of future capability with simple updates of the receiver firmware.

This IRAD project will leverage past IRAD efforts under which the discrete component RF card for the NavCube was developed and initially integrated with the SpaceCube. The objectives of the proposed project are integration and test of the NavCube hardware and existing L1/L2 tracking capability, and design and implementation of a modernized L5 GPS signal tracking capability on the NavDev platform.

Anticipated Benefits

Many NASA programs can benefit from the special capabilities and efficiencies that will be offered by the NavCube technology developed under this IRAD work. Sample programs that could benefit include ISS demonstration missions (e.g., GEDI-lite, the proposed FARMS imaging sensor, the proposed satellite servicing mission RESTORE and other ISS payloads) and other small satellite LEO missions.



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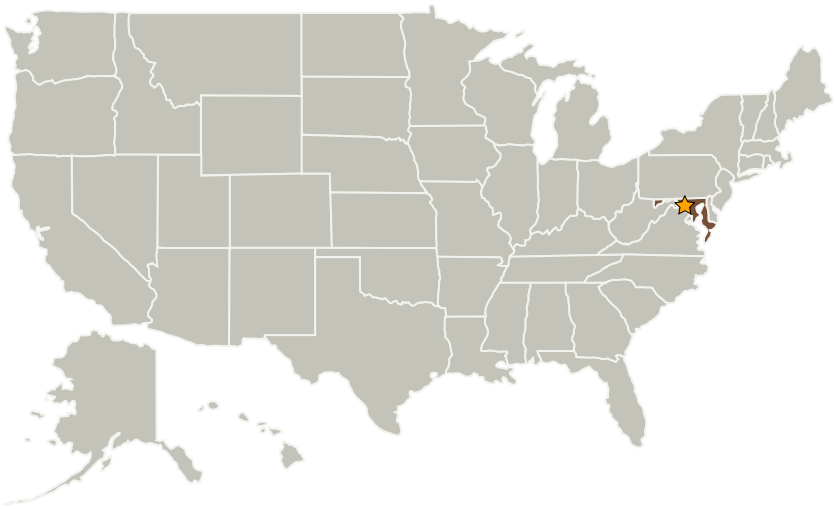
In space GPS signals

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations
Maryland

Organizational Responsibility

Responsible Mission Directorate:

Mission Support Directorate (MSD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Center Independent Research & Development: GSFC IRAD

Project Management

Program Manager:

Peter M Hughes

Project Manager:

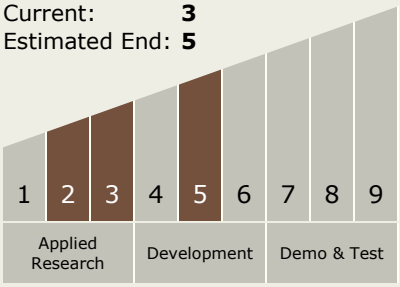
Dennis W Woodfork

Principal Investigator:

Munther A Hassouneh

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **5**



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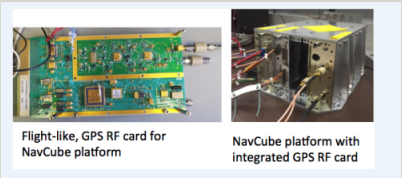
Images



NavCube: A fully realized modernized GPS receiver Project
NavCube: A fully realized modernized GPS receiver Project *(https://techport.nasa.gov/image/19348)*

Links

GSC-17453-1
(no url provided)

Project Website:

http://aetd.gsfc.nasa.gov/

Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.4 Microwave, Millimeter-, and Submillimeter-Waves